ORIGINAL RESEARCH

Development and evaluation of bat rabies education materials

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Abstract: Bat exposures account for a quarter of the human rabies treatments in New York and a large share of the annual prophylaxis costs of US$1.8 million. To reduce the number of treatments associated with bats that are not captured and tested for rabies, the authors developed a refrigerator magnet to advise residents to consider the risk of rabies exposure from bat encounters, and a sticker to warn children not to touch bats. Surveys were administered to adults and children in schools, fairs and camps to assess the effectiveness of the magnet and sticker. After receiving a magnet, significantly more respondents knew not to immediately release a bat found in their home (82.5% of those surveyed a second time after receiving a magnet and 60.0% surveyed only once after receiving a magnet, compared with 16.7% of those surveyed before receiving the magnet and 26.5% of those never receiving one). Significantly more respondents said that they would not touch a bat after the intervention (95.5% versus 84.7% in the magnet survey, 95.5% versus 91.1% in the sticker survey) or that they would tell an adult about seeing a bat (94.6% versus 91.0%). These educational measures have the potential to significantly reduce health care costs associated with bat rabies without increasing the risk of human cases.

Keywords: rabies, health education, communicable diseases, evaluation studies

Introduction

In the 1990s, dramatic changes took place in the incidence of human cases of rabies in the USA. Between 1980 and 1990, 7 cases of domestically acquired human rabies had been reported in the USA, but from 1991 to 1998 the number increased to 24. At the same time, bat rabies variants became recognised as the predominant variant associated with human disease. Before 1990, bat variants of the rabies virus were confirmed in 2 of the 7 cases (29%). Of the 24 cases in the next 8 years, bat rabies variants were recovered from 20 cases (83%), but actual bites were reported for only two of the 20. Some contact with bats was reported in five more cases, but no exposures to bats were definitively established for the remaining 13 cases (Krebs et al 1998; Noah et al 1998).

In 1999, the Advisory Committee on Immunization Practices of the Centers for Disease Control and Prevention (CDC) issued updated recommendations for the prevention of human rabies reflecting the newly recognised pattern of human rabies in the USA (CDC 1999). Following these guidelines, the New York State Department of Health (NYSDOH) now recommends postexposure prophylaxis (PEP) 'when there is reasonable probability' that human exposure to rabies might have occurred, such as when an adult finds a bat in a room with an unattended child or wakes up to find a bat in the room (NYSDOH 1999). Thus, bat rabies education must be directed towards informing the public about recognising possible exposure situations. In contrast, rabies exposure from other species is likely to be from a larger bite wound and the risk of rabies would be assessed by the health care practitioners treating the wound.

Along with alerting New York State (NYS) residents to the risk of rabies presented by encounters with bats, another goal of the education programme is to decrease the number of PEPs. Although bats represented only 4.6% of the rabid animals in New York from 1993–1998, exposure to bats accounted for 25.8% of the PEPs, and a large share of the estimated average annual statewide PEP cost of US$1.8 million (Chang et al 2002). Treatment can be avoided if the bat is captured and tests negative for rabies. The cost difference between treatment (an average of US$927 each) and testing (US$75) is large. Given that less than 4% of bats tested in New York are infected with rabies (Childs et al 1994), the majority of PEPs currently administered would not be necessary if bats in exposure situations were tested. In addition, of bats submitted in NYS with any possibility of human contact, 90% are shown not to be rabid (Debbie

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and Trimarchi 1997). Thus, the NYSDOH Zoonoses Program developed bat rabies educational materials to inform people that certain encounters with bats may present a rabies exposure risk and to encourage the submission of bats for testing if there is a possibility that an exposure has occurred.

NYSDOH recognises the need to target these messages to children as well as adults. In the 5 cases of bat-variant rabies infections among children since 1980, the child had no recollection of the exposure. That was true of New York's first rabies death in 40 years, in 1993: an 11-year-old with no reported contact with a bat was infected with a variant identified as that of an indigenous bat (CDC 1993; Noah et al 1998; NYSDOH 2000). An important component of the bat rabies education initiative is to encourage children to avoid bats and tell an adult if they do encounter one.

To reduce the risk of human bat-associated rabies cases and the number of rabies treatments associated with exposure to non-rabid bats, NYSDOH developed and evaluated specific bat rabies educational materials.

Methods

Education materials

Among the materials the NYSDOH Zoonoses Program developed are a bat rabies sticker and a magnet. Printed on iridescent silver paper with a prismatic mosaic design, the 3-inch-diameter sticker carries the image of two flying bats with a dialogue bubble coming from one, saying, 'Don't Touch Me . . . I could have rabies! If you see me, tell an adult' (Figure 1). Children of 9 or even younger should find it easy to understand and may stick it to a notebook, backpack or toy. Printing costs were less than 6 cents each. The magnet, 3.25 inches tall and 4 inches wide, is intended for a slightly older teen audience but is also appropriate for adults (Figure 2). Printed on flexible magnetic plastic and entitled 'Bat Rabies Alert', the magnet advises that bats play a role in nature but may also carry rabies. It explains that rabies is a deadly virus and instructs people NOT to release a bat found in the home but rather, 'Immediately contact your local health department for advice on what to do'. The magnets cost 18 cents each.

Figure 1 The bat rabies sticker.

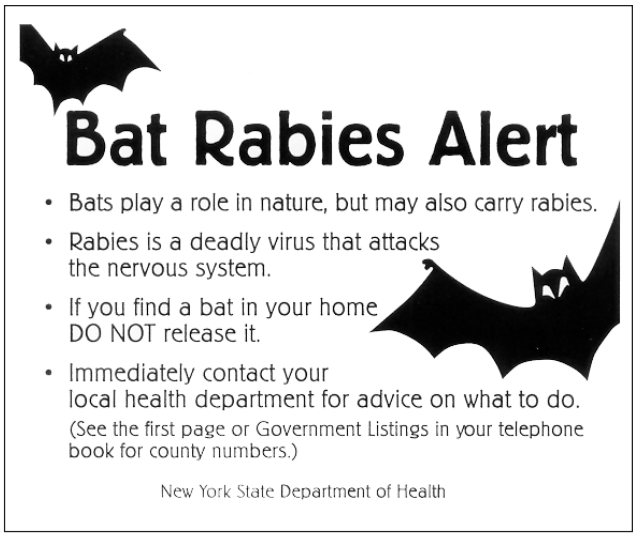

Figure 2 The bat rabies magnet.

Both the stickers and the magnets are designed for long-term high visibility. Encounters with bats are infrequent, and rabies education messages are not broadcast to the public on a regular basis, so these materials must serve as readily available reminders of what to do following a bat encounter.

Education intervention

In the spring and summer of 1999, representatives of state and county health departments offered rabies education programmes to children and adults in various settings (schools, health fairs, summer programmes, the New York State Fair, and elementary school Conservation Day events). Stickers and magnets were distributed and surveys were administered to evaluate whether the materials increased people's knowledge about bat rabies. Evaluation of the stickers and magnets was completed before the individuals received any other educational materials about rabies in those settings.

Individuals were asked to complete a survey about their past experiences with bats, general knowledge of bats and rabies, and awareness of steps they should take if they

encounter a bat. Some respondents completed the survey and then answered the same questions again after having received a magnet or a sticker (the pre/post-intervention groups). Others completed the survey only after having received a magnet or a sticker (intervention groups), and still others completed it without having received any educational material at all (control groups). Adults as well as children were surveyed, but in some settings only one age group was available.

Both surveys asked whether the respondent had ever seen bats in various circumstances (inside a bedroom, at school or at camp) or had actually touched a bat. For an assessment of general rabies knowledge, each person was asked if rabies can make people sick and whether he or she personally had ever consulted a doctor about an animal bite. All respondents were asked two questions concerning the proper steps to take upon encountering a bat. Respondents to the sticker survey, all children, were asked, 'If you see a bat, should you tell an adult?'. The correct answer is 'Yes'. An adult is needed to capture the bat for testing or to investigate the possible need for PEP for the child. They were also asked, 'If you see a bat, is it okay to touch it?'. The correct answer is 'No', because of the danger of bites and rabies infection.

Respondents to the magnet survey were asked the same question about seeing a bat, and also, 'If you find a bat in your home, should you open a window and release it as soon as possible?'. The correct answer to this question is 'No', because if the bat is released before the possibility of a rabies exposure is assessed, some persons may require PEP.

Data analysis

Epi6.04 and SAS were used for data entry and analysis, respectively. Proportions were analysed by study design (pre/post-intervention versus intervention/control), study setting (schools, fairs, other programmes) and demographic characteristics (sex and age). For analyses of differences by demographic or study characteristics, all survey responses were pooled for respondents receiving each educational intervention, ie a magnet or sticker. The differences in proportions of respondents providing correct answers to the survey questions were tested using the chi-square test (for independent samples of sufficient size), Fisher's exact test (for independent samples of small size) or McNemar's test (for the matched-pair samples in the pre/post-intervention study). A level of significance equal to 0.05 was used for all tests.

Results

Eight hundred and fifty-three persons participated in the evaluation (665 children and teenagers, 179 adults, plus 9 persons with their age missing) (Table 1). For the pre/post-intervention study design, 234 respondents (ages 6–83)

Table 1 Characteristics of respondents

	Magnet survey						*Sticker survey*					
	Pre/post-intervention		*Control group*		*Intervention group*		*Pre/post-intervention*		*Control group*		*Intervention group*	
Characteristics	*n*	*Mean age*	*n*	*Mean age*	*n*	*Mean age*	*n*	*Mean age*[a]	*n*	*Mean age*[a]	*n*	*Mean* age[b]
All respondents	234	26	34	44	35	42	202	10	162	11	186	11
Females	158	28	19	43	18	40	111	10	78	11	91	11
Males	76	22	15	44	17	43	90	10	83	11	95	11
Ages 6–11	8	10.25	0		0		171	9.22	132	10.89	151	10.85
Ages 12–19	117	12.95	0		0		30	13.13	28	12.25	28	12.21
Ages 20+	109	41.2	34	43.82	35	41.57	0		1	25	0	
County fair	0		0		0		37	10	0		0	
Health fair	125	37.5	0		0		91	10	0		0	
School	101	12.8	0		0		56	9	0		0	
Summer programme	8	13.5	0		0		18	9.5	0		0	
New York State Fair	0		34	44	35	42	0		0		0	
Conservation day events	0		0		0		0		162	11	186	11

[a] Age is missing for one respondent in this group.
[b] Age is missing for seven respondents in this group.

completed the magnet survey before receiving a magnet and then again after having received it, and 202 children or teenagers (ages 8–19) completed the sticker survey both before and after receiving the sticker. For the intervention/control study design, 34 persons at the New York State Fair completed the magnet survey without having seen a magnet (control group), and 35 persons at the fair completed it after having received a magnet (intervention group). For the sticker study, 161 children at a Conservation Day event (plus one adult) who had not seen a sticker (control group) and 186 children at the same event who had seen the sticker (intervention group) completed surveys. For comparisons of respondents who completed surveys after having received the magnet or sticker, the pooled samples of post-intervention and intervention groups were composed of 269 respondents to the magnet survey and 387 respondents to the sticker survey.

Respondents' general knowledge and previous experiences

For these background questions, responses were pooled. About one-third of all respondents had seen or heard of a bat in their own homes or at their or their children's camps (Table 2). Less than 10% had seen or heard of a bat in their own bedrooms or at their or their children's school. Slightly more respondents reported having touched a bat (13.1%) or seeing a doctor because of an animal bite (15.1%). Most respondents were aware that rabies made people sick.

Table 2 Respondents' past experience with bats and general knowledge of rabies

	Number (%) responding 'Yes'		
Survey questions	*Total (n = 853)*[a]	*Age < 20 (n = 665)*	*Age ≥20 (n = 179)*
Ever seen a bat in your house?	286 (33.5)	222 (33.4)	59 (33.0)
Ever seen a bat in your bedroom?	84 (9.9)	63 (9.5)	20 (11.2)
Ever seen/heard of a bat in your/your child's school?	62 (7.3)	53 (8.0)	7 (4.0)
Ever seen/heard of a bat in your/your child's camp?	318 (37.6)	269 (40.7)	44 (25.0)
Ever touched a bat?	111 (13.1)	86 (13.0)	23 (13.0)
Doctor's visit due to an animal bite?	128 (15.1)	93 (14.0)	32 (17.9)
Can rabies make you sick?	800 (94.1)	619 (93.4)	178 (99.4)

[a] Age is missing for 9 respondents.

Table 3 Percentage of respondents providing correct answers to questions concerning encounters with bats

Survey questions	*Nr*	*Respondents providing correct answer (%)*	*Significance (p value)*[a]
If you find a bat in your home, should you release it as soon as possible? (magnet survey)			
Group pre-intervention	234	16.7	< 0.001
Group post-intervention	234	82.5	
Control group	34	26.5	0.005
Intervention group	35	60.0	
If you see a bat, is it okay to touch it? (magnet survey)			
Group pre-intervention	234	84.7	< 0.001
Group post-intervention	234	95.5	
Control group	34	91.2	0.72
Intervention group	35	88.2	
If you see a bat, is it okay to touch it? (sticker survey)			
Group pre-intervention	202	91.1	0.02
Group post-intervention	202	95.5	
Control group	161	95.0	0.7
Intervention group	186	94.1	
If you see a bat, should you tell an adult? (sticker survey)			
Group pre-intervention	202	91.0	0.046
Group post-intervention	202	94.6	
Control group	161	87.0	0.62
Intervention group	186	88.7	

[a] For respondents receiving a survey both pre-intervention and post-intervention, a McNemar test for paired designs was utilised. For comparison of respondents completing the survey only once, after no intervention (control group) or an intervention (intervention group), a chi-square or Fisher's exact test was utilised.

However, prior experience with bats was not found to be associated with the specific knowledge factors examined for this study (see below).

Reported responses to encountering a bat

In the intervention assessment, more respondents who were provided a magnet knew not to immediately release a bat found in their home compared with those who had not been provided a magnet (Table 3). The difference was statistically significant and large among respondents in the post/pre-intervention group (82.5% versus 16.7%) and in the intervention/control groups (60.0% versus 26.5%), although the higher proportion in the post-intervention group compared with the intervention group was also statistically significant (p=0.004).

Knowledge about touching bats and telling an adult if a bat is seen was high even prior to the interventions. However,

significantly more respondents said that they would not touch a bat after the intervention (95.5% versus 84.7% in the magnet survey, 95.5% versus 91.1% in the sticker survey) or that they would tell an adult about seeing a bat (94.6% versus 91.0%). Those completing the survey for the second time (post-intervention group) were significantly more likely than those in the intervention group (asked only once) to say they would tell an adult that they saw a bat (94.6% versus 88.7%, p=0.037).

Bivariate analyses

Table 4 provides the results of bivariate analyses of associations between knowledge and characteristics of respondents or the study setting, with responses of all respondents after receiving the sticker or magnet pooled.

Only a few differences by sex and/or age were noted. Among children receiving a sticker, a significantly lower proportion of boys than of girls (87.6% versus 96.0%) said they would tell an adult if they saw a bat, and a significantly lower proportion (84.9%) of older children (12 years or more) than of younger children (93.2%) said they would inform an adult. A comparison of boys and girls in the same age group indicated that it was the older boys (age 12–19) who accounted for the difference. Boys aged 6–11 were slightly more likely than girls of the same age to say they would not tell an adult if they saw a bat (9.7% versus 4.5%, p=0.07), but older boys were much more likely than older girls (22% versus 0%, p=0.02) to give this (incorrect) response.

A similar pattern is noted among adults answering the question about releasing a bat from the home as soon as possible. Fewer adult men than adult women (62.2% versus 83.2%, p=0.0008) said that it is not okay to release a bat immediately.

Children evaluated after receiving the magnet during a summer programme were significantly less likely to answer correctly the question about releasing a bat found in the home (25.0%) than were those evaluated at health fairs (82.4%) or schools (86.0%).

Table 4 Differences in proportion of respondents providing correct answers by demographic characteristic or study setting

Survey questions	*Nr*	*Respondents answering correctly in post-intervention and intervention study groups combined (%)*[a]	*Significance (p value)*[b]
If you find a bat in your home, should you release it as soon as possible? (magnet survey)			
Gender/age			0.008
Females ≥20 years	107	83.2	
Males ≥20 years	37	62.2	
Study setting (children only)			0.0007
School	100	86.0	
Health fair	17	82.4	
Summer programme	8	25.0	
If you see a bat, should you tell an adult? (sticker survey)			
Gender			0.002
Females	202	96.0	
Males	185	87.6	
Age			0.025
6–11	322	93.2	
12–19	66	84.9	
Gender/age			0.017
Females aged 12–19 years	22	100.0	
Males aged 12–19 years	36	77.8	

[a] The post-intervention group had already completed a survey, then received a sticker or magnet, and then completed the survey a second time. The intervention group completed surveys after receiving a magnet or sticker but without having previously completed a pre-intervention survey.

[b] P-value for statistical test for difference in proportion answering correctly among groups of respondents. Either the chi-square test or Fisher's exact test was used, depending on sample size.

Discussion

With the recognition of the high prevalence of bat-variant rabies among human rabies infections has come a greater need to inform the public of the danger presented by exposures to bats. Because people usually seek wound care for bites from larger animals, health care personnel can triage bite victims appropriately to avoid human rabies cases. However, private individuals must know enough about bat rabies to initiate appropriate actions: for children, informing an adult; and for adults, consulting with a health agency or provider and helping to submit the bat for testing. The bat rabies education materials developed by the NYSDOH were designed to promote these actions.

Fortunately, most people appear to know the most basic recommendations: 85% or more of respondents said they should not touch bats, and 88% or more of the children knew to tell an adult if they see a bat. The recommendation against releasing a bat from a home is less familiar to people, with less than 20% correctly answering this question. However, after receiving a magnet with this message, 79.6% said that bats found indoors should not be released right away. The failure to understand and act on this recommendation increases the risk of unnecessary PEP as well as the risk of rabies.

Rabies sticker for children

The poorer performance on the sticker survey among older children and boys should be noted. Younger children and girls may have paid more attention to the stickers; stickers sold in toy and craft stores seem to be marketed toward these groups. Perhaps the younger students approached the survey with the concentration they give to school assignments while the older ones recognised it as an extracurricular activity. Also, older boys may be more interested in and confident with wildlife, and see no need for help from adults. Nevertheless, the sticker programme appears to be a useful strategy for opening the rabies prevention dialogue with young children. Repeated exposure to the messages, which may be accomplished by use of a long-lasting medium like a sticker, reinforces retention of the information. Older children and boys may require use of alternative materials.

The higher proportion of correct answers to questions among those surveyed twice suggests an influence in addition to that of the stickers: being asked a question about a topic helps a person remember what is said about the topic in subsequent messages. Children who have just been asked whether it is okay to touch a bat may pay more attention to a 'Don't Touch Me!' message than children who are seeing it without prior preparation. This may support having stickers provided in conjunction with additional rabies educational activities. Thus, a focus on presentations at schools or organised nature activities may be helpful. In another study, students aged 7–11 years in New Zealand who were surveyed on household risks of burns showed greater improvement on second tests if they had completed an educational exercise than if they had not (Harre and Coveney 2000). An alternative explanation is that the children in the pre/post-intervention study groups (those surveyed at county fairs, health fairs, schools, summer programmes) were different in ways that influenced their learning of the sticker's message, compared with children surveyed only once after receiving the sticker (at a Conservation Day event). The mean age was 9–10 years for the former groups, 11 years for the latter.

Rabies refrigerator magnet

The difference in responses to the magnet survey by the post-intervention group and those in the intervention group suggests that for the older audience, there is a positive effect of seeing the material twice. Those in the post-intervention group may have been more receptive to the magnet message because they had just seen a question about it on the pre-intervention survey. However, other personal characteristics associated with the different settings for the surveys may have influenced these results. Those receiving the survey twice as part of the pre/post-intervention study design participated through health fairs, school and summer programmes, and their mean age varied by setting from 13.5 to 37.5 years. For those receiving the survey only once after viewing the magnet, the mean age was 42 years.

Differences by sex and age in responses concerning the immediate release of bats are also worth noting. Only 62% of adult men versus 83% of women who had received a magnet with the message not to release a bat found in the home said they would act in accordance with this advice. In a school setting (average age 13), 86% said they would not immediately release a bat after receiving a magnet. Similarly, an evaluation of a health education curriculum in Irish secondary schools found that, among both teens and young adults, females reported more positive health behaviours than males (Gabhainn and Kelleher 2000).

The magnet's final message is that people should contact their local health department for advice on what to do. Perhaps the adults who answered that they would release a bat assumed that the 'advice' would concern techniques for release (which they feel they already know). About one-third of adults who completed the magnet survey had ever seen a bat in their own house, but the proportion was not much higher among those who favour immediate release than among those who responded correctly. Or perhaps the message on the magnet did not override basic fears about bats in homes and desires to get rid of them as soon as possible.

It is also noteworthy that no association was found between any factor and the likelihood of stating that it is not okay to touch a bat. No matter how the message not to touch a bat is delivered, most people need little persuading to follow this advice.

Conclusion

The preponderance of human rabies deaths being associated with bat rabies, and the high number of bat-related human rabies treatments, are important public health problems. Many of these treatments follow encounters in which the bat was not available for rabies testing. With only a small proportion of bats being rabid, those treatments and health care costs are potentially avoidable. From our initial evaluation, refrigerator magnets with the message to avoid releasing bats in homes appear to be one effective way to educate people about retaining bats for testing. Thus, their large-scale distribution could potentially save millions of dollars in treatment costs.

Although there was a significant improvement in knowledge after receipt of the sticker about touching bats and telling adults if one is seen, it is less clear from this evaluation whether large-scale distribution of the stickers would be a cost-effective way to protect children and reduce unnecessary treatments. Most of the pre-teen children receiving the sticker appeared to realise even beforehand that they should not touch a bat and should tell an adult if they see one. The sticker may be more effective with younger children, but a tool other than a written survey is needed to assess its effect.

There are several limitations to our study results and conclusions. Due to resource issues, the evaluations could not be conducted in a systematic manner with more control over personal characteristics of the respondents or study venue. Thus, unidentified factors may have influenced the results, making it difficult to generalise our findings to the population at large. Long-term retention of the knowledge gained was not assessed. However, both stickers and magnets were designed to remain in place for long periods to encourage repeated exposures to the educational message. More study is needed to understand individual differences (for example, in gender and age) in the successful acquisition of educational messages. Finally, knowing the correct answer to survey questions does not ensure the correct behavioural response. Although bats are not extraordinarily difficult to capture inside a home, some knowledge, advice, equipment (container with a lid, gloves) are valuable. If homeowners are unable to obtain immediate help from local health agencies or pest control operators in capturing a bat, they may risk personal exposure during capture. We are aware of few bat bites occurring in this way, but fear of contact may influence decisions to open the window and release a bat despite the need to determine its rabies status. The increased submission of bats for testing will require laboratories to have sufficient resources for increased specimen loads. Priority must be given to testing bats involved in incidents for which PEP would be recommended unless rabies is ruled out.

Subsequent studies will pilot test a larger scale city or county implementation with long-term follow-up. Information on knowledge retention and behavioural change is needed to determine the cost-effectiveness of large-scale provision of magnets in terms of the number of PEPs saved.

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References

[CDC] Centers for Disease Control and Prevention. 1993. Human rabies – New York, 1993. *MMWR Morb Mortal Wkly Rep*, 42:799, 805–6.

[CDC] Centers for Disease Control and Prevention. 1999. Human rabies prevention – United States, 1999: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Morb Mortal Wkly Rep*, 48(RR-1):1–21.

Chang HGH, Eidson M, Noonan-Toly C et al. 2002. Public health impact of reemergence of rabies, New York. *Emerg Infect Dis*, 8:909–13.

Childs J, Trimarchi CV, Krebs JW. 1994. The epidemiology of bat rabies in New York State, 1988–1992. *Epidemiol Infect*, 113:501–11.

Debbie JG, Trimarchi CV. 1997. Prophylaxis for suspected exposure to bat rabies. *Lancet*, 350:1790–1.

Gabhainn NS, Kelleher CC. 2000. School health education and gender: an interactive effect? *Health Educ Res*, 15:591–602.

Harre N, Coveney A. 2000. School-based scalds prevention: reaching children and their families. *Health Educ Res*, 15:191–202.

Krebs JW, Smith JS, Rupprecht CE et al. 1998. Rabies surveillance in the United States during 1997. *J Am Vet Med Assoc*, 213:1713–28.

[NYSDOH] New York State Department of Health. 1999. Guidelines for managing bats and risk of rabies transmission [online]. Accessed 24 Mar 2004. URL: http://www.health.state.ny.us/nysdoh/zoonoses/batmanage.pdf

[NYSDOH] New York State Department of Health. 2000. Bat rabies in New York State [online]. Accessed 24 Mar 2004. URL: http://www.health.state.ny.us/nysdoh/zoonoses/bigbatbook.pdf

Noah DL, Drenzek CL, Smith JS et al. 1998. Epidemiology of human rabies in the United States, 1980 to 1996. *Ann Intern Med*, 128: 922–30.